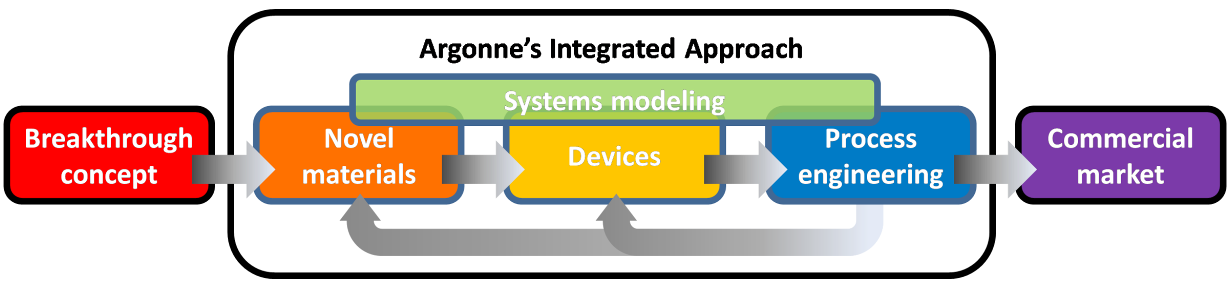
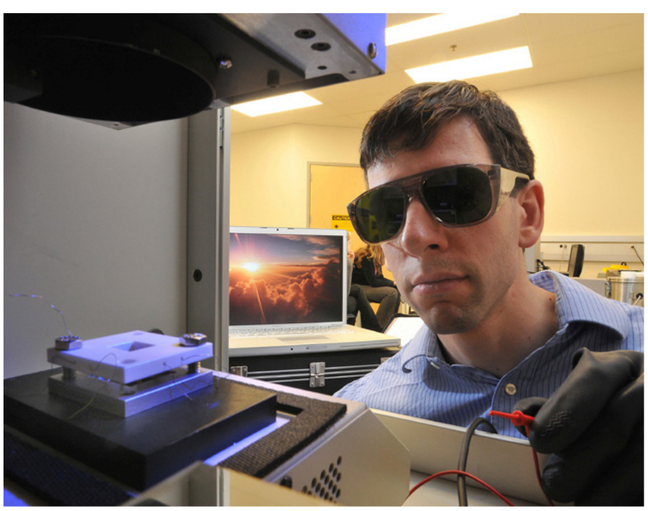
Argonne NATIONAL LABORATORY | Solar Energy Initiative

Solar Energy Research at Argonne

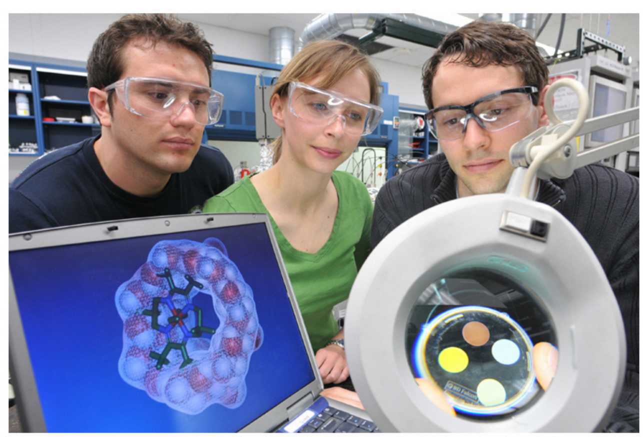
Solar energy represents by far the most abundant carbon-neutral, renewable energy source. Its large-scale introduction into the market, however, continues to be hindered by high costs. As a part of our solar energy strategy, Argonne has partnered with Northwestern University and other world-class research universities to form the Argonne-Northwestern Solar Energy Research (ANSER) Center. The long-term vision of this center is to develop the fundamental understanding, materials and methods necessary to create dramatically more efficient technologies for solar fuels and electricity production.



Implementation of this methodology involves cooperation among Argonne investigators in novel solar materials; device studies; systems modeling; identification, evaluation, and mitigation of deployment issues; and process engineering. Argonne's solar strategy is built around this generalizable methodology; specific material systems such as Argonne's novel nanostructured solar materials will be guided through the translational approach. We aim to demonstrate technologies that are cost competitive with fossil fuels in 10 years.



Argonne scientist Seth Darling measures the efficiency of an organic solar cell.



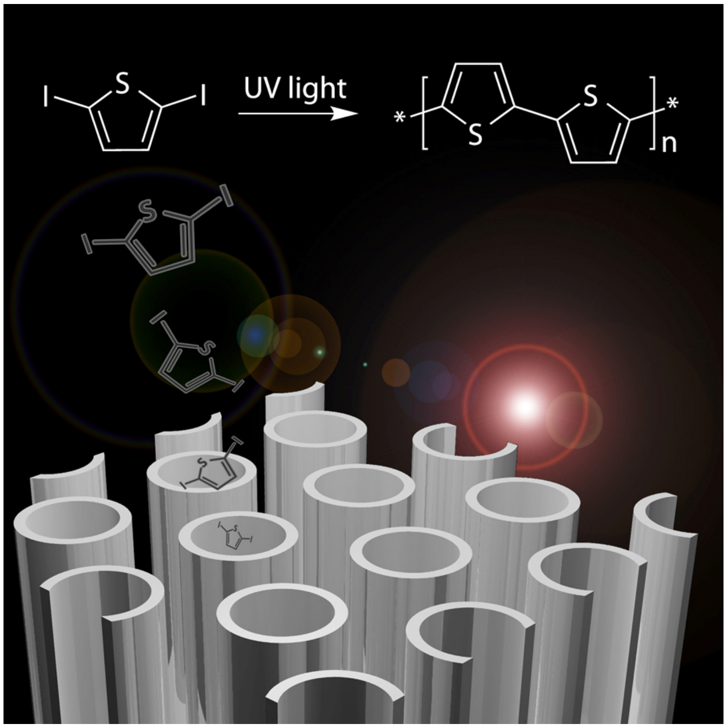
Argonne scientists Ioan Botiz, Karen Mulfort, and Alex Martinson examine nanostructured photovoltaic and solar fuel materials.

Recent Highlights

"Homegrown" hybrid solar cell aims for low-cost power

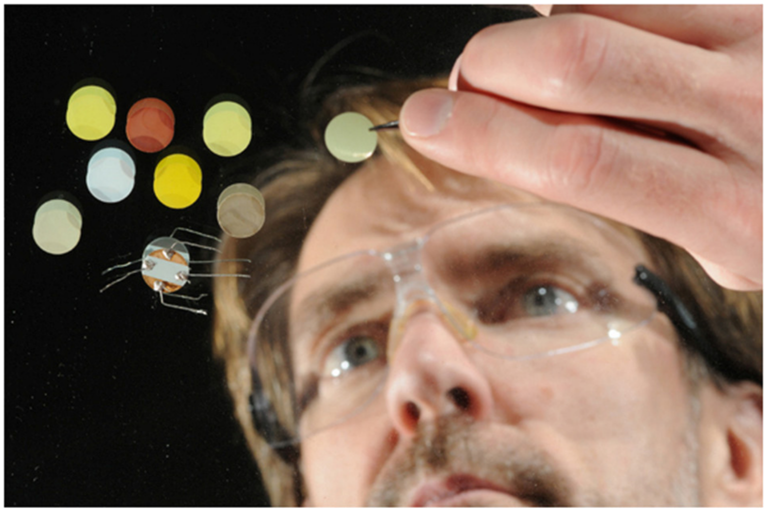
Argonne scientists have refined a technique to manufacture solar cells by creating nanotubes of semiconducting material and then "growing" polymers directly inside them. The method has the potential to be far cheaper than the process used in today's commercial solar cells.

Filling nanotubes with polymer leads to bending and twisting, which leads to inefficiencies both because it traps pockets of air as it goes and because twisted polymers don't conduct charges as well. Trying to sidestep this problem, the team hit on the idea of growing the polymer directly inside the tubes. They filled the tubes with a polymer precursor, turned on ultraviolet light, and let the polymers grow within the tubes. These devices dramatically outperform those fabricated by filling the nanotubes with pre-grown polymer.



In situ polymerization within a semiconductor nanotube array improves device performance.

Improved dye-sensitized solar cells using atomic layer deposition



Argonne scientist Jeff Elam examines solar cell components fabricated using atomic layer deposition.

Dye-sensitized solar cells (DSCs) are a type of thin film photovoltaic that show great promise to displace current technologies. DSCs are fabricated using inexpensive processes that use cheap, abundant materials, but extensive deployment is prevented by modest module efficiency and the relatively poor stability of current devices.

Argonne scientists have developed a novel concept in which the conventional titanium dioxide nanoparticle array is replaced with an interdigitated structure comprised of thin, conformal films to reduce charge collection times. Films are deposited using a technique called atomic layer deposition, which permits highly controlled growth of a broad variety of functional materials.

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